

Technical University of Denmark



## Gate design in injection molding of microfluidic components using process simulations

Marhöfer, David Maximilian; Tosello, Guido; Islam, Aminul; Hansen, Hans Nørgaard

*Publication date:*  
2015

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*

Marhöfer, D. M., Tosello, G., Islam, A., & Hansen, H. N. (2015). Gate design in injection molding of microfluidic components using process simulations. Abstract from Micro/Nano Manufacturing Workshop, Teddington, United Kingdom.

## DTU Library

Technical Information Center of Denmark

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# Gate design in injection molding of microfluidic components using process simulations

David Maximilian Marhöfer, Guido Tosello, Aminul Islam, Hans Nørgaard Hansen

Technical University of Denmark, Department for Mechanical Engineering, Produktionstorvet 427, 2800 Kongens Lyngby, Denmark

[maxmar@mek.dtu.dk](mailto:maxmar@mek.dtu.dk)

## Abstract

Process simulations are an effective design and optimization tool in conventional as well as micro injection molding ( $\mu$ IM). They can be applied to optimize and assist the design of the micro part, the mold, the micro cavity and the  $\mu$ IM process. Available simulation software is however developed for macroscopic plastic parts. By using the correct implementation and careful modelling though, it can also be applied to micro parts. In the present work, process simulations were applied to a microfluidic distributor and a microfluidic mixer of which features were in the 100  $\mu$ m dimensional range. The meshing and the challenges of the two devices in the simulation software to obtain a proper simulation model were described. Focus of the investigation was on the filling pattern and the optimization of selected gate designs. Subsequently, the simulation results were used to find the most appropriate gate design with regard to moulding process window, polymer flow, and part quality. This finally led to an optimization of the design and the realization as actual steel mold. Additionally, the simulation results were critically discussed and possible improvements and limitations of the gained results and the deployed software are presented. Ultimately, the simulation results were validated by comparing the flow pattern behavior of the polymer flow predicted by the simulation with the actual flow front at different time steps. These were realized by molding short shots with the realized molds and were compared to the simulations at the global, i.e. part level, and at the local, i.e. feature level (see Figure 1).

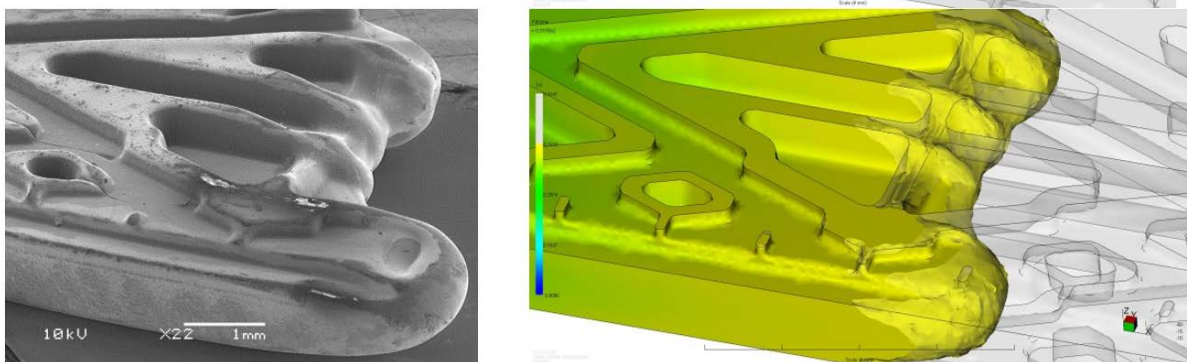


Figure 1: Comparison between actually molded and simulated plastic part during the filling phase.